Market States and MAX Effect: The Role of Jackpot Probability

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Abstract

Stocks with high maximum daily return over the previous month (MAX) have low expected returns. This effect varies with market states, specifically, this effect vanishes following bear markets. We also find that the absence of the MAX effect following bear markets is due to jackpot realizations of high MAX stocks when markets rebound. This is the offsetting of the positive effect due to jackpot probability against the negative effect due to lottery preference. Our results are not driven by investor sentiment or additional risk of jackpot probability.

JEL Classification: G11, G12, G14

Keywords: Lottery-like payoffs, Jackpot probability, Market states

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1. Introduction

Investors prefer stocks with lottery-like payoffs. Consequently, these stocks are overpriced (Kumar, 2009). According to this investor preference, stocks with high maximum daily return over the previous month (MAX) have low expected returns (Bali, Cakici, and Whitelaw, 2011). Bali et al. (2011) assert that preferences for lottery stocks could be generated by the optimal beliefs theory by Brunnermeier, Gollier, and Parker (2007). Moreover, Barberis and Huang (2008) argue that stocks with positive skewness can be overpriced considering the implications of cumulative prospect theory (Tversky and Kahneman, 1992). Investors overweight a tail probability which means they overestimate a small probability of extreme positive returns. The MAX portfolio which longs high MAX stocks and shorts low MAX stocks proposed by Bali et al. (2011), has a negative, significant raw return and alphas on average.

This pervasive anomaly by lottery preference of investors would vary with market states, since the preference is changing depending on market states. Fong and Toh (2014) assert that the MAX effect is stronger following high investor sentiment. This is consistent with the optimal belief framework since investor optimism is larger when sentiment is higher. Generally, investor sentiment is high in bull markets, the MAX effect would shrink following bear markets. On the other hand, since the demand for stocks with lottery-like payoffs increases during economic downturns (Kumar, 2009), the MAX effect could be pronounced following bear markets. We examine how this anomaly varies with market states and disclose the causes of the phenomenon.

We provide a new aspect that can affect profits of the MAX portfolio, beside lottery preference of investors based on the cumulative prospect theory and the optimal belief theory. High MAX stocks have lottery characteristics which lead to a large probability of jackpot

realizations. When jackpot returns for high MAX stocks are realized, the MAX portfolio which shorts high MAX stocks would have insignificant or even positive returns. We establish the hypothesis that jackpot realizations of high MAX stocks are concentrated following bear markets, and consequently, the MAX effect vanishes following bear markets. This is consistent with the Merton (1974) model. In this model, a stock has a call option payoff when the stock is distressed, then the stock has more skewed payoff. Following bear markets, these skewed payoffs are pronounced and probability of extreme positive returns, jackpot probability, goes up (Conrad, Kapadia, and Xing, 2014). Then high MAX stocks have higher probability of jackpot returns in bear market.

We first examine how the MAX effect varies depending on the market states. We define two past market states: as a bull market when the previous two-year CRSP value-weighted return is nonnegative and a bear market if otherwise. We find that the MAX effect is only significant following bull markets. The average of raw returns and risk-adjusted returns for MAX portfolio are not significant in bear markets. This paper shows that the main reason for this difference is jackpot realizations of high MAX stocks following bear markets.

To test our hypothesis that the MAX effect vanishes due to jackpot realizations of high MAX stocks following bear markets, we examine the role of the jackpot probability in Conrad et al. (2014) in the MAX effect. Conrad et al. (2014) argue that stocks with high predicted probabilities for jackpot returns are overpriced, which is consistent with the lottery preference of investors. Therefore, the correlation between MAX and jackpot probability is high and it is more pronounced in bear markets. Moreover, difference in jackpot probability between high and low MAX stocks is larger in bear markets. This explains the difference in the MAX effect between two market states.

We then provide several evidences that jackpot realizations are the main reason for the

absence of the MAX effect following bear markets. We define two contemporaneous market states: as an up market when the contemporaneous CRSP value-weighted excess return is nonnegative and down market if otherwise. Together with past market states, we classify market states into four different states and examine the MAX effect in each state. We find that the MAX effect disappears only when markets rebound, or when contemporaneous up markets with past bear markets. According to return distributions of high and low MAX stocks for each four market states, we can conclude that high MAX stocks are likely to have jackpot return realizations when markets rebound.

We also present results of Fama-Macbeth (1973) regressions to support the jackpot realization story. Before controlling for the jackpot probability, the MAX effect is significant only following bull markets. However, after controlling for the jackpot probability, the MAX effect is significant both following bull and bear markets. This is due to positive effect of the jackpot probability after controlling for the MAX following bear markets. Especially, this positive effect is pronounced when markets rebound. This fact implies that stocks are more likely to exhibit jackpot returns when markets rebound, especially for high MAX stocks. Consequently, absence of the MAX effect following bear markets is due to the offsetting of the positive effect from high probability of jackpot realizations of high MAX stocks following bear markets against the negative effect from overvaluation by lottery preference.

These results suggest the connection between MAX and jackpot probability. We can separate the return predictability of the MAX into two main parts. The first part is the negative predictability from investors' lottery preference. The second part is the positive predictability from high jackpot probability of high MAX stocks in bear markets. The predictability comes from jackpot realizations when markets rebound. Investors can easily observe MAX, so it mainly captures lottery preference. The return predictability from jackpot

realizations of the MAX is wholly subsumed by the jackpot probability. On the other hand, since the jackpot probability is difficult to calculate, it mainly predicts jackpot realizations after controlling for the MAX, especially in bear markets. We can check this by above results of Fama-Macbeth regressions. Since the second part of the MAX return predictability is only pronounced in bear markets, the MAX effect disappears following bear markets.

We provide two alternative explanations and show that they are not appropriate. First, the positive return predictability of the jackpot probability after controlling for the MAX is not explained by additional risk. By running Fama-Macbeth regressions, we compare return predictabilities of the jackpot characteristic and the factor loading. Since the coefficient of the factor loading is not significant, we can conclude this is not an additional risk factor.

Second, the difference in the MAX effect between two market states is not driven by difference in investor sentiment. Fong and Toh (2014) assert that the MAX effect is more pronounced following high investor sentiment states. In bull markets, investor sentiment is likely to be high, the difference in the MAX effect might be driven by investor sentiment. However, the realizations of jackpot returns are not shown in contemporaneous up markets with low sentiment states. Therefore, high returns of high MAX stocks from jackpot realizations are dependent on the past market states, not the investor sentiment.

The rest of the paper is organized as follows. Section 2 describes the sample and the variable descriptions. Section 3 presents difference in the MAX portfolio between bull and bear markets. Section 4 provides analyses related to the connection between the MAX and the jackpot probability. Section 5 includes alternative explanations and robustness checks. Section 6 concludes.

2. Data and variable descriptions

For this research, we used stock trading data, accounting data, Fama-French factors, and investor sentiments data. The whole data period we used is from 1951 to 2015, which is the period that accounting data is available. Since we need to estimate jackpot probability with at least 20 years of data to follow the method of Conrad et al. (2014) and the first ex-ante jackpot probability obtained is at the end of June 1972. Therefore, the period of analyzed portfolio performance is from July 1972 to Dec 2015. Detailed definition of each variable is listed on the Appendix.

Stock return data is come from The Center for Research in Security Prices (CRSP) dataset. We used monthly and daily stock returns, prices, and shares outstanding data to do our analysis. We only used common stocks which are listed in NYSE, AMEX, or NASDAQ. In each month, we excluded stocks with market cap below 5% percentile of NYSE breakpoint of market capitalization, and stocks with price below $1 at the end of each month to exclude the effects from penny stocks. Also, a stock must be listed and traded at least 600 days in past 5 years to be included as a sample in our study. We have used Fama-French factors to risk-adjusted each returns. We had changed some filtering criteria to check robustness, and the main results are qualitatively same.

Accounting data is come from COMPUSTAT. Annual accounting data is used to calculate B/M ratio and some of variables that is used to estimate jackpot probability. We assumed that 6 months are need to accounting data is publicly available following the literatures. Therefore, we match year-end accounting data to the stock data at the end of June.

We have defined jackpot probability (JACKPOTP) following the definition in Conrad et al. (2014) to measure jackpot probability but slightly changed their definition. We have

excluded two variables they used, size and momentum, and included price to estimate our jackpot probability to see the jackpot probability orthogonalized to some known risk factors. Except that variable change, all methods are same as Conrad et al. (2014).

We have divided market state in four states using two criteria following the definition used in Daniel and Moskowitz (2016). First, in ex ante, we have defined past market state as bull market when past two year CRSP value-weighted return is nonnegative and bear market otherwise. Second, in ex post, we have defined contemporaneous market stated as up market when contemporaneous CRSP value-weighted excess return to risk-free rate is nonnegative and down market otherwise.

Finally, we used orthogonalized investor sentiment data in Wurgler's homepage used in Baker and Wurgler (2006). We divided market state using sentiment data to compare with the analysis of Fong and Toh (2014). Market sentiment is set as high when the orthogonalized investor sentiment index is above median of sample period and low otherwise.

3. Market states and the MAX effect

Barberis and Huang (2008) argue that a stock with positive skewness can be overpriced considering the implications of cumulative prospect theory. Investors who have a preference for stocks with lottery-like payoffs buy high MAX stocks, consequently, high MAX stocks are overpriced (Bali, Cakici, and Whitelaw, 2011) and have return reversal over next month. As a result, the MAX portfolio that longs high MAX stocks and shorts low MAX stocks have a negative average return.

Table 1 represents monthly returns for decile portfolios that are sorted by the MAX. The

MAX portfolio that longs high MAX decile portfolio and shorts low MAX decile portfolio, have a negative, significant raw return and alphas on average. Specifically, the average raw return of the strategy is −0.99% per month with a t-statistic of −3.65, the average 4-factor alpha is −1.12% per month with a t-statistic of −7.14. Considering the distribution across decile portfolios, the MAX portfolio returns are driven by the high MAX portfolio.

[Table 1 about here]

We examined how the MAX effect varies depend on past market states, whether bull or bear. Fong and Toh (2014) argue that when investor sentiment is higher, bigger investor optimism generates bigger lottery preference. Then, high MAX stocks are more overpriced and the MAX effect becomes bigger. From another point of view, when the market condition is distressed, default probability goes up and option-like payoffs of distressed stocks are exposed (Merton, 1974). This leads to positively skewed payoffs and probability of extreme positive returns, jackpot probability, goes up (Conrad, Kapadia, and Xing, 2014). In addition, high MAX stocks have lottery-like payoffs (Bali, Cakici, and Whitelaw, 2011) so we can expect that they have greater jackpot probability than low MAX stocks. If preference for high jackpot probability is not fully reflected to a stock price, more jackpot realizations lead to greater returns of high MAX portfolio. Then the MAX portfolio returns are smaller when jackpot probability is higher. In both the sentiment story and the jackpot story, we can expect that the MAX effect is greater in bull markets than in bear markets.

Table 2 represents the average of raw returns and alphas depending on past market states. In bull markets, the average raw return and 4-factor alpha are negative and significant, specifically −1.16% per month with a t-statistic −4.26 and −1.14% per month with a t-statistics −7.31, respectively. However, in bear markets, they are not significant. The average raw return is even positive in bear markets. Based on the jackpot story, we examined why the

MAX effect varies across the past market states.

[Table 2 about here]

To see how different are characteristics of the MAX portfolio depending on market states, we represent summary statistics in Table 3. Consistent with our hypothesis, both Merton DD default probability and JACKPOTP is increasing from low MAX decile to high MAX decile. Moreover, this tendency is more strong in bear markets and overall magnitude of both probabilities are bigger.

[Table 3 about here]

4. Connection between MAX and jackpot probability

In this section, we examine the connection between MAX and jackpot probability more deeply. In Panel A of Table 4, we can see how the jackpot probability and varies across past market states and the MAX, and it is consistent with our predictions. The jackpot probability is greater for high MAX stocks than low MAX stocks, and this difference is more pronounced in bear markets. Panel B of Table 4 reports the correlation between MAX and jackpot probability. Correlation is very high and they are getting higher in bear markets. These results imply that high MAX stocks are more likely to have jackpot realizations in bear markets.

[Table 4 about here]

If jackpots are realized, high MAX portfolio will have large positive returns, and the MAX effect will vanish. We can expect that the MAX effect would be different depending on contemporaneous market returns since jackpots are likely to be realized with

contemporaneous up markets. Also, this difference would only appear in bear markets with high probability of jackpot returns.

Table 5 represents the average raw returns and risk-adjusted returns for MAX strategy for each market states. Both in bull and bear markets, the average raw return is positively significant in contemporaneous up markets and negatively significant in contemporaneous down markets. High MAX stocks tend to have high beta, so the average LMH raw returns are opposite direction of contemporaneous market returns. If we adjust returns by risks including market beta, the effect of beta is disappeared. Since JACKPOTP difference across the MAX portfolio is small and correlation between MAX and JACKPOTP is low in bull markets, risk-adjusted return difference is not appeared between two different contemporaneous market states. On the other hand, the MAX effect is disappeared when the market rebounds. In bear markets, jackpot returns of high MAX portfolios are realized with contemporaneous up markets. Table 6 represents the return distribution of high and low MAX stocks. We can see that high MAX stocks are likely to have extreme positive returns when markets rebound which means jackpots are likely to be realized. As a result, there is no MAX effect when the market rebounds.

[Table 5 about here]

[Table 6 about here]

We also present results of Fama-Macbeth (1973) regressions to support the jackpot realization story. In Panel A of Table 7, we represent the results with three specifications for each past market states. Before controlling for the jackpot probability, the MAX effect is significant only in bull markets except last specification. This is because size and momentum predict jackpot realization although they are risk factors. Conrad et al. (2014) include size and

previous 12 month returns to predict jackpot probability. Therefore, this result is consistent with our hypothesis. After controlling for the JACKPOTP, the MAX effect is significant both in bull and bear markets. This is due to positive effect of the JACKPOTP after controlling for the MAX in bear markets. For all three specifications, coefficients of JACKPOTP is positive and significant in bear markets, while it is insignificant in bull markets.

In Panel B of Table 7, we provide the regression results in market rebound states. The positive effect of JACKPOTP is especially pronounced when markets rebound. This fact implies that stocks are more likely to exhibit jackpot returns when markets rebound, especially for high MAX stocks. Consequently, absence of the MAX effect in bear markets is due to the offsetting of the negative effect from overvaluation by lottery preference against the positive effect from high probability of jackpot realizations of high MAX stocks.

[Table 7 about here]

These results suggest the connection between MAX and jackpot probability. We can separate the return predictability of the MAX into two main parts. First part is the negative predictability from investors' lottery preference. Second part is the positive predictability from the jackpot realizations of high MAX stocks in bear markets. Investors can easily observe the MAX, so it mainly captures lottery preference. The return predictability from jackpot realizations of the MAX is wholly subsumed by the jackpot probability. On the other hand, since the jackpot probability is difficult to calculate, it mainly predicts jackpot realizations after controlling for the MAX, especially in bear markets. We can check this by above results of Fama-Macbeth (1973) regressions. Since the second part of the MAX return predictability is only pronounced in bear markets, the MAX effect disappears in bear markets.

5. Alternative explanations and robustness checks

In this section, we provide two alternative explanations and show that they are not appropriate explanations. First, the positive return predictability of the jackpot probability after controlling for the MAX is not explained by additional risk. By running Fama-Macbeth regressions, we compare return predictabilities of the jackpot characteristic and the factor loading. Since the coefficient of the factor loading is not significant, we can conclude this is not an additional risk factor.

[Table 8 about here]

Second, the difference in the MAX effect between two market states is not driven by difference in investor sentiment. Fong and Toh (2014) assert that the MAX effect is only significant following high investor sentiment states. In bull markets, investor sentiment is likely to be high, the difference in the MAX effect might be driven by investor sentiment. However, the realizations of jackpot returns are not shown in contemporaneous up markets with low sentiment states. Therefore, high returns of high MAX stocks from jackpot realizations are depending on the past market states, not the investor sentiment.

[Table 9 about here]

Next, we provide some robustness checks. Our key results are that due to jackpot realizations when markets rebound, significance of the MAX portfolio returns are affected. Therefore, we provide the average raw returns for each market states, bull, bear, and rebound, with various robustness controls. Almost of them have same patterns with Table 2 and Table 5 which means our results are robust.

[Table 10 about here]

6. Conclusions

We provide a new aspect that can affect profits of the MAX portfolio, beside lottery preference of investors based on the cumulative prospect theory and the optimal belief theory. High MAX stocks have lottery characteristics which lead to large probability of jackpot realizations. When jackpot returns for high MAX stocks are realized, the MAX portfolio which shorts high MAX stocks would have insignificant or even positive returns. We show that jackpot realizations of high MAX stocks are concentrated following bear markets, and consequently, the MAX effect vanishes following bear markets. This is consistent with the Merton (1974) model. In this model, a stock has a call option payoff when the stock is distressed, then the stock has more skewed payoff. Folloing bear markets, these skewed payoffs are pronounced and probability of extreme positive returns, jackpot probability, goes up (Conrad, Kapadia, and Xing, 2014). Then high MAX stocks have higher probability of jackpot returns following bear market.

Our results suggest the connection between MAX and jackpot probability. We can separate the return predictability of the MAX into two main parts. The first part is the negative predictability from investors' lottery preference. The second part is the positive predictability from high jackpot probability of high MAX stocks following bear markets. The predictability comes from jackpot realizations when markets rebound. Investors can easily observe MAX, so it mainly captures lottery preference. The return predictability from jackpot realizations of the MAX is wholly subsumed by the jackpot probability. On the other hand, since the jackpot probability is difficult to calculate, it mainly predicts jackpot realizations after controlling for the MAX, especially in bear markets. Since the second part of the MAX return predictability is only pronounced in bear markets, the MAX effect disappears in bear markets.

Appendix. Variable Descriptions

MAX: MAX is the maximum daily return within a month as documented in Bali et al. (2011).

JACKPOTP: JACKPOTP is the ex-ante measure of jackpot probability calculated using the method of Conrad et al. (2014). Specifically, we used seven variables, which are slightly different in their paper. We bring SKEW, AGE, TANG, SALESGRTH, TURN, STDEV in their main analysis, and we included PRC to those 6 variables. PRC is log of share price. JACKPOT is binary variable which has value 1 when the log of one year return from July to June is greater than 1 and 0 otherwise. In the end of each June, logit regression which regresses JACKPOT on SKEW, AGE, TANG, SALESGRTH, TURN, STDEV, PRC is estimated in the sample of firm-years which all independent and dependent variables exist.

At least 20 years are required to start this estimation. Then, using that estimated coefficients, each firm's ex-ante jackpot probability is estimated for next twelve months.

BETA: BETA is market beta which is estimated within care of nonsynchronous trading. Specifically, beta is estimated in following regression.

$$r_{i,t} - r_{f,t} = \alpha + \beta_{1,i}(r_{m,t} - r_{f,t}) + \beta_{2,i}(r_{m,t-1} - r_{f,t-1}) + \beta_{3,i}(r_{m,t-2} - r_{f,t-2}) + \beta_{4,i}(r_{m,t-3} - r_{f,t-3}) + \beta_{5,i}(r_{m,t-4} - r_{f,t-4}) + \epsilon_{i,t}$$

We estimate that regression for each stock-month using the data of immediate previous 6 months. BETA is then defined as the summation of five lagged estimated betas.

SIZE: SIZE is log of the market value of equity which is calculated by multiplying share price and shares outstanding.

BM: BM is the log ratio of firm's book value to market value calculated with the method of Fama and French (1992).

TOTMOM: TOTMOM is the cumulative return of each stock over the previous 11 months excluding immediate previous month. In other word, it is the cumulative return of each stock over one year ago to one month ago.

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Table 1. MAX portfolio returns.

Table 1 represents monthly return of MAX portfolios, including raw return, CAPM Alpha, 3-factor alpha, and 4-factor alpha, and the average of maximum daily return over previous month, which are represented as MAX. MAX portfolios are constructed based on the method of Bali et al. (2011). Decile 1 portfolio contains stocks that exhibit lowest 10% maximum daily returns over previous month, while Decile 10 portfolio contains stocks that exhibit highest 10% maximum daily returns over previous month. 10-1 strategy is a zero investment strategy that longs Decile 10 portfolio and shorts Decile 1 portfolio. CAPM, Fama-French 3 factor, Carhart 4 factor adjustment is done based on full-sample period. All portfolio returns are calculated based on equal-weighted method. All returns are from monthly return and represented in percent. T-statistics are represented in parentheses. Sample period is from 1972:07 to 2015:12.

MAX decile	Raw return	CAPM alpha	3-factor alpha	4-factor alpha	MAX
1 (Low)	1.27	0.52	0.33	0.35	1.51
2	1.34	0.50	0.28	0.33	2.39
3	1.34	0.46	0.25	0.29	2.99
4	1.34	0.42	0.21	0.27	3.57
5	1.32	0.36	0.15	0.22	4.19
6	1.31	0.32	0.12	0.21	4.89
7	1.23	0.19	0.00	0.10	5.75
8	1.11	0.03	−0.10	0.02	6.92
9	0.89	−0.23	−0.36	−0.19	8.79
10 (High)	0.28	−0.87	−0.99	−0.77	15.60
10−1	−0.99	−1.39	−1.32	−1.12	
	(−3.65)	(−6.34)	(−8.15)	(−7.14)	

Table 2. MAX portfolio returns by past market states.

Table 2 represents monthly return of MAX portfolios divided by past market state, including raw return, CAPM alpha, 3-factor alpha, and 4-factor alpha, and the average of maximum daily return over previous month, which are represented as MAX. Past market state is set as bull market when previous two-year CRSP value-weighted return is nonnegative and bear market otherwise. CAPM, Fama-French 3 factor, Carhart 4 factor adjustment is done based on full-sample period and that alphas are meaned according to market state. All portfolio returns are calculated based on equal-weighted method. All returns are from monthly return and represented in percent. T-statistics are represented in parentheses. Sample period is from 1972:07 to 2015:12..

Panel A: Bull markets

MAX decile	Raw return	CAPM alpha	3-factor alpha	4-factor alpha	MAX
1 (Low)	1.25	0.45	0.27	0.30	1.40
2	1.34	0.44	0.25	0.31	2.25
3	1.30	0.36	0.18	0.24	2.83
4	1.32	0.34	0.17	0.25	3.39
5	1.30	0.28	0.12	0.21	3.98
6	1.24	0.18	0.05	0.16	4.66
7	1.14	0.04	−0.07	0.05	5.49
8	1.01	−0.13	−0.17	−0.01	6.61
9	0.76	−0.43	−0.44	−0.23	8.41
10 (High)	0.08	−1.14	−1.11	−0.83	14.99
10−1	−1.16	−1.60	−1.39	−1.14	
	(−4.26)	(−6.87)	(−9.06)	(−7.31)	
Number of months	444				

Panel B: Bear markets

MAX decile	Raw return	CAPM alpha	3-factor alpha	4-factor alpha	MAX
1 (Low)	1.41	0.94	0.63	0.62	2.12
2	1.34	0.82	0.47	0.45	3.18
3	1.59	1.03	0.64	0.62	3.92
4	1.43	0.85	0.40	0.37	4.62
5	1.42	0.82	0.31	0.28	5.37
6	1.75	1.12	0.55	0.52	6.21
7	1.72	1.06	0.40	0.36	7.25

8	1.66	0.98	0.26	0.21	8.67
9	1.64	0.93	0.09	0.02	10.90
10 (High)	1.42	0.69	−0.29	−0.38	19.06
10−1	0.01 (0.01)	−0.25 (−0.40)	−0.92 (−1.43)	−1.01 (−1.79)	
Number of months	78				

Table 3. Summary statistics of MAX portfolios by past market states.

Table 3 represents summary statistics of MAX portfolios. MAX represents maximum daily return of previous month. JACKPOTP means jackpot probability, which is calculated via the method of Conrad, Kapadia, and Xing (2014). Merton DD default prob. means default probability, which is calculated by the method of Merton (1974). Beta is market beta calculated using previous 6-month daily return of each stock. Size is firm's market cap. BM represents book-to-market ratio. Momentum represents previous 11-month cumulative return that skips last month. All returns are from monthly return and represented in percent. Sample period is from 1972:07 to 2015:12..

Panel A: Bull markets

MAX decile	MAX	JACKPOTP	Merton DD default prob.	Beta	Size	BM	Momentum
1 (Low)	1.40	0.64	0.11	0.61	535.80	0.88	19.25
2	2.25	0.69	0.15	0.77	467.64	0.84	17.38
3	2.83	0.78	0.18	0.86	400.13	0.82	18.00
4	3.39	0.86	0.24	0.95	325.29	0.81	18.98
5	3.98	0.96	0.34	1.01	269.40	0.80	20.26
6	4.66	1.07	0.41	1.08	217.79	0.80	21.91
7	5.49	1.20	0.51	1.15	176.41	0.80	24.19
8	6.61	1.37	0.70	1.22	134.86	0.79	26.55
9	8.41	1.62	0.97	1.30	103.46	0.79	29.29
10 (High)	14.99	2.17	2.17	1.37	72.23	0.82	29.30

Panel B: Bear markets

MAX decile	MAX	JACKPOTP	Merton DD default prob.	Beta	Size	BM	Momentum
1 (Low)	2.12	0.82	0.32	0.62	585.54	0.93	12.09
2	3.18	0.92	0.50	0.78	505.61	0.89	8.57
3	3.92	1.04	0.68	0.88	404.75	0.89	8.69
4	4.62	1.18	0.93	0.97	346.05	0.91	9.27
5	5.37	1.34	1.15	1.06	281.54	0.95	8.60
6	6.21	1.52	1.50	1.15	231.52	0.97	9.02
7	7.25	1.75	1.91	1.26	192.03	1.03	9.29
8	8.67	2.06	2.66	1.38	142.30	1.07	10.74
9	10.90	2.55	3.88	1.51	109.07	1.09	9.75
10 (High)	19.06	3.75	7.72	1.73	72.46	1.26	6.71

Table 4. JACKPOTP of MAX portfolios.

Table 4 represents MAX portfolio's mean JACKPOTP and correlation between MAX and JACKPOT. Panel A represents mean JACKPOTP of each MAX portfolio divided by past market state. Difference row represents difference of difference in JACKPOTP of Decile 1 and Decile 10 of bull market and bear market. Panel B represents correlation between MAX and JACKPOTP divided by past market state. Difference row represents difference of correlation between MAX and JACKPOTP of bull market and bear market. All probabilities are represented in percent. T-statistics are represented in parentheses. Sample period is from 1972:07 to 2015:12.

Panel A: Average JACKPOTP for each MAX decile

MAX decile	1 (Low)	2	3	4	5	6	7	8	9	10 (High)	10−1
Bull markets	0.64	0.69	0.78	0.86	0.96	1.07	1.20	1.37	1.62	2.17	1.52
Bear markets	0.82	0.92	1.04	1.18	1.34	1.52	1.75	2.06	2.55	3.75	2.92
Difference											1.40
											(7.85)

Panel B: Correlation between MAX and JACKPOTP

All markets	0.506
Bull markets	0.500
Bear markets	0.543
Difference	0.043
	(4.09)

Table 5. Risk-adjusted MAX portfolio return and market state.

Table 5 represents raw and risk-adjusted MAX portfolio returns divided by past and contemporaneous market state. Contemporaneous market state is set as up market when contemporaneous CRSP value-weighted excess return is nonnegative and down market otherwise. CAPM, Fama-French 3 factor, Carhart 4 factor adjustment is done based on full-sample period and that alphas are meaned according to market state. All returns are from monthly return and represented in percent. T-statistics are represented in parentheses. Sample period is from 1972:07 to 2015:12.

Past markets	Bull		Bear	
Contemporaneous markets	Up	Down	Up	Down
Raw return	0.85	−4.10	5.38	−5.94
	(2.51)	(−11.50)	(5.07)	(−7.64)
CAPM alpha	−1.65	−1.52	1.14	−1.80
	(−4.97)	(−4.98)	(1.19)	(−2.38)
3-factor alpha	−1.59	−1.09	0.75	−2.78
	(−7.87)	(−4.68)	(0.80)	(−3.57)
4-factor alpha	−1.25	−0.97	0.29	−2.46
	(−6.12)	(−4.06)	(0.37)	(−3.23)
Number of months	263	181	41	37

Table 6. Return distribution of MAX portfolios.

Table 6 represents the monthly individual return distribution of stocks in each MAX portfolios. Panel A represents the distribution of raw monthly return, while Panel B represents the distribution of CAPM adjusted alpha, which is calculated via each stock's 6-month rolling CAPM adjustment. All returns are from monthly return and represented in percent. Sample period is from 1972:07 to 2015:12.

Panel A: Raw return

Contemporaneous markets	Up				Down			
Past markets	Bull		Bear		Bull		Bear	
MAX	High	Low	High	Low	High	Low	High	Low
Percentiles								
1%	−35.71	−14.66	−37.72	−15.42	−47.25	−23.20	−57.74	−31.78
5%	−20.19	−7.17	−20.34	−7.17	−30.76	−13.15	−39.76	−17.97
10%	−14.21	−4.42	−13.63	−4.04	−23.39	−9.37	−31.79	−12.54
25%	−5.86	−0.80	−3.30	−0.22	−13.79	−4.67	−19.04	−6.37
50%	1.89	2.06	6.93	3.48	−5.18	−0.65	−8.47	−1.33
75%	11.11	6.16	20.23	8.42	2.26	2.36	0.97	2.56
90%	23.35	11.20	37.73	14.42	11.47	6.41	11.99	7.35
95%	33.33	15.27	52.68	19.78	19.50	9.76	20.40	11.14
99%	64.14	26.01	92.64	35.83	41.77	19.75	45.58	21.73

Panel B: CAPM adjusted alpha

MAX	High	Low	High	Low	High	Low	High	Low
Percentiles								
1%	−42.80	−17.33	−51.99	−21.36	−40.48	−18.58	−45.97	−24.87
5%	−26.12	−9.44	−31.32	−11.22	−24.11	−10.15	−28.50	−12.15
10%	−19.22	−6.54	−22.66	−7.49	−17.74	−6.90	−20.57	−8.18
25%	−10.11	−2.68	−11.31	−3.04	−9.35	−2.80	−9.88	−3.16
50%	−1.66	0.55	−0.61	0.89	−1.33	0.63	−0.37	0.96
75%	7.09	4.25	11.50	5.38	6.31	4.06	9.20	5.19
90%	18.49	8.94	27.92	10.84	16.08	8.45	20.99	10.21
95%	28.51	12.78	41.18	15.85	24.52	11.85	30.28	14.20
99%	58.35	23.42	79.89	31.15	47.35	22.03	56.90	25.77

Table 7. Fama-Macbeth regression results on MAX and JACKPOTP.

Table 7 represents the results of time series average of cross-sectional regression following the method of Fama-Macbeth (1973). In each regression, dependent variable is the return of each stock, while independent variable contains MAX, JACKPOTP, Beta, Size, BM, and Momentum. Panel A represents the time series average of each cross-sectional regression divided by past market state, while Panel B represents the time series average of each cross-sectional regression in rebound state. All returns are from monthly return and represented in percent. T-statistics are represented in parentheses. Sample period is from 1972:07 to 2015:12.

Panel A: Bull markets vs. Bear markets

	MAX	JACKPOTP	Beta	Size	BM	Momentum
Bull	−0.084					
	(−6.73)					
	−0.082	−0.003				
	(−10.94)	(−0.10)				
Bear	−0.007					
	(−0.19)					
	−0.060	0.225				
	(−2.60)	(2.29)				
Bull	−0.082		0.075		0.229	
	(−8.44)		(0.78)		(4.25)	
	−0.081	0.007	0.055		0.226	
	(−11.62)	(0.29)	(0.64)		(4.32)	
Bear	−0.026		0.637		0.252	
	(−0.97)		(1.57)		(1.19)	
	−0.066	0.206	0.371		0.229	
	(−3.76)	(2.53)	(1.04)		(1.12)	
Bull	−0.084		0.052	−0.063	0.192	0.008
	(−10.79)		(0.59)	(−1.65)	(3.48)	(6.63)
	−0.081	−0.008	0.051	−0.075	0.186	0.007
	(−11.85)	(−0.36)	(0.64)	(−2.46)	(3.84)	(6.73)
Bear	−0.052		0.521	−0.268	0.108	−0.004
	(−2.36)		(1.48)	(−2.52)	(0.56)	(−0.93)
	−0.067	0.153	0.323	−0.132	0.174	−0.004
	(−3.95)	(2.05)	(1.07)	(−1.54)	(0.91)	(−0.85)

Panel B: Market rebounds (bear markets with contemporaneous up markets)

Bear and contemporaneous up markets	0.211					
	(4.71)					
	0.037	0.739				
	(1.20)	(6.96)				
	0.089		2.889		0.098	
	(2.60)		(5.68)		(0.31)	
	−0.018	0.552	2.261		0.033	
	(−0.71)	(5.86)	(4.82)		(0.11)	
	0.040		2.660	−0.522	−0.156	−0.014
	(1.44)		(6.75)	(−3.40)	(−0.54)	(−1.78)
	−0.027	0.535	2.066	−0.033	0.068	−1.341
	(−1.06)	(6.89)	(5.87)	(−0.26)	(0.23)	(−1.66)

Table 8. Fama-Macbeth regression results on MAX, JACKPOTP and beta of JACKPOTP

Table 8 represents the results of time series average of cross-sectional regression following the method of Fama-Macbeth (1973). In each regression, dependent variable is the return of each stock, while independent variable contains MAX, JACKPOTP, $\beta_{JACKPOTP}$, Beta, Size, BM, and Momentum. $\beta_{JACKPOTP}$ is the coefficient of jackpot long-short portfolio in monthly rolling regression of past 5-year including Carhart 4 factors and jackpot long-short portfolio.. All returns are from monthly return and represented in percent. T-statistics are represented in parentheses. Sample period is from 1972:07 to 2015:12

	MAX	JACKPOTP	$\beta_{JACKPOTP}$	Beta	Size	BM	Momentum
Bear	−0.067	0.153		0.323	−0.132	0.174	−0.004
	(−3.95)	(2.05)		(1.07)	(−1.54)	(0.91)	(−0.85)
	−0.051		−0.053	0.525	−0.268	0.121	−0.005
	(−2.53)		(−0.27)	(1.52)	(−2.57)	(0.64)	(−0.99)
	−0.065	0.157	−0.133	0.337	−0.134	0.183	−0.004
	(−4.04)	(2.14)	(−0.74)	(1.13)	(−1.54)	(0.96)	(−0.90)
Bear and contemporaneous up markets	−0.027	0.535		2.066	−0.033	0.068	−0.013
	(−1.06)	(6.89)		(5.87)	(−0.26)	(0.23)	(−1.66)
	0.034		0.408	2.604	−0.496	−0.117	−0.015
	(1.28)		(1.58)	(6.63)	(−3.30)	(−0.41)	(−1.88)
	−0.029	0.532	0.089	2.052	−0.024	0.088	−0.013
	(−1.14)	(6.78)	(0.37)	(5.91)	(−0.19)	(0.30)	(−1.72)

Table 9. Risk-adjusted MAX portfolio return and investor sentiment.

Table 9 represents raw and risk-adjusted MAX portfolio returns divided by investor sentiment and contemporaneous market state. Investor sentiment is set as high when the orthogonalized investor sentiment index created by Baker and Wurgler (2006) is above median of sample period and low otherwise. CAPM, Fama-French 3 factor, Carhart 4 factor adjustment is done based on full-sample period and that alphas are meaned according to market state. All returns are from monthly return and represented in percent. T-statistics are represented in parentheses. Sample period is from 1972:07 to 2015:12.

Investor sentiment	High		Low	
Contemporaneous markets	Up	Down	Up	Down
Raw return	0.52	−5.06	2.42	−3.79
	(1.05)	(−9.09)	(5.46)	(−10.79)
CAPM alpha	−2.02	−2.19	−0.52	−0.96
	(−4.04)	(−4.54)	(−1.35)	(−3.17)
3-factor alpha	−1.70	−1.98	−0.83	−0.80
	(−5.78)	(−5.30)	(−2.56)	(−2.76)
4-factor alpha	−1.42	−1.76	−0.65	−0.71
	(−4.92)	(−4.87)	(−2.20)	(−2.29)

Table 10. Robustness checks.

Table 10 provides some robustness checks. Long-short MAX portfolio raw returns are represented. In Panel A, momentum-neutral MAX portfolios are constructed using 10-by-10 dependent sort method. In Panel B, the definition of MAX variable is changed as the average of daily 5 maximum return of previous month. In Panel C, definition of past market state is changed. Past market state is set as bull market when previous one(three)-year CRSP value-weighted return is nonnegative and bear market otherwise. In Panel D, stocks are first sorted into three groups by size using the NYSE breakpoint, and then long-short MAX portfolio returns are calculated. In Panel E, each portfolio's return is calculated using value-weighted method. All returns are from monthly return and represented in percent. T-statistics are represented in parentheses. Sample period is from 1972:07 to 2015:12.

Market states	Bull markets	Bear markets	Market rebounds
Panel A: Momentum neutral			
	−0.74	−0.30	2.89
	(−3.63)	(−0.56)	(5.62)
Panel B: MAX definition			
MAX(5)	−1.31	−0.18	5.56
	(−4.44)	(−0.18)	(4.74)
Panel C: Market states definition			
Past 1-year	−1.03	−0.81	4.08
	(−3.70)	(−1.11)	(4.10)
Past 3-year	−1.23	0.34	4.19
	(−4.41)	(0.39)	(4.39)
Panel D: NYSE size			
Small	−1.60	−0.35	4.93
	(−5.70)	(−0.38)	(4.57)
Medium	−1.16	0.01	5.38
	(−4.26)	(0.01)	(5.08)
Big	−0.22	−0.06	4.67
	(−0.85)	(−0.07)	(4.19)
Panel E: Value-weighted returns			
	−0.74	0.33	6.26
	(−2.69)	(0.31)	(5.14)